Meningococcal Infection (Invasive)

(Including Meningitis, Meningococcemia, Pneumonia and Other Invasive Infections)

Report Immediately

Note: This chapter focuses only on meningococcal infections, caused by *Neisseria meningitidis.* For information about other kinds of meningitis, refer to the chapters entitled "Meningitis, Viral" and "Meningitis, General (Multiple Etiologies)."

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Invasive meningococcal infections are caused by the bacterium *Neisseria meningitidis* (the meningococcus), a gram-negative diplococcus. There are 13 serogroups of *N. meningitidis*; nine of these serogroups are known to cause invasive disease (A, B, C1+, C1-, L, X, Y, W-135, and Z) in humans.

B. Clinical Description

Invasive infection with *N. meningitidis* may cause several clinical syndromes, including meningitis, bacteremia, sepsis or pneumonia. Symptoms of **meningitis** (infection of the meninges, the membrane covering the central nervous system) typically include the sudden onset of a stiff neck, high fever and headache. A petechial rash may be present. Nausea, vomiting and mental confusion are often also present. **Meningococcemia** (infection of the blood) typically presents with the abrupt onset of fever, chills, malaise, prostration and rash (urticarial, maculopapular, purpuric or petechial). Fulminant cases present with purpura, disseminated intravascular coagulation, shock, and/or coma and may lead to death within hours despite appropriate therapy. The case-fatality rate for meningococcal meningitis and meningococcemia is about 10–15% even with appropriate antibiotic treatment. Persons with certain complement deficiencies (blood disorders that cause immunocompromise) are prone to recurrent disease and persons without a functioning spleen are more susceptible to bacteremic illness.

C. Reservoirs

Humans are the only known reservoir of *N. meningitidis*.

D. Modes of Transmission

The principal mode of transmission of *N. meningitidis* is person-to-person through direct contact with a case's oral or nasal secretions. The bacteria may also be spread through droplets or via an inanimate vehicle contaminated with saliva (*e.g.*, a cigarette or water bottle).

E. Incubation Period

The incubation period is variable, 1–10 days, usually 2–4 days.

F. Period of Communicability or Infectious Period

Cases remain infectious as long as meningococci are present in oral secretions or until 24 hours after initiation of effective antibiotic treatment.

G. Epidemiology

Sporadic cases and occasional outbreaks of invasive meningococcal disease occur worldwide. A "meningitis belt" extends from sub-Saharan Africa into India/Nepal, and invasive meningococcal disease due to *N. meningitidis* serogroup A is considered endemic in these areas. Epidemics of meningococcal meningitis also occur in this meningitis belt every 8 to 12 years and last from 2 to 4 years. Seasonal variations occur in these epidemics, usually in dry, hot seasons. The prevalent serotypes of *N. meningitidis* vary over time and by geography.

In the United States, the largest number of cases of invasive meningococcal disease usually occur during the winter and early spring, coincident with an increase in the occurrence of acute respiratory infections. Historically in the US, cases of invasive meningococcal disease were most commonly seen in children under 5 years of age. However, the age distribution of cases appears to be shifting to an older population. The peak incidence groups are young children (under age 5), adolescents and young adults, and the elderly. Meningococcal pneumonia is more commonly seen in older patients. In the US, outbreaks of invasive meningococcal disease occur most frequently in crowded conditions (*i.e.*, military bases, college dormitories). Cases of invasive meningococcal disease in the US are most often caused by serogroups B, C and Y (each accounting for approximately 30% of reported cases), although other serogroups are also seen sporadically. Epidemics of invasive disease are most commonly associated with serogroups C and Y.

Meningococcal carriage: N. meningitidis typically colonizes the nose and throat of 5-15% of the general population at any given time. These carriers are generally asymptomatic, and carriage of the bacteria may act as an immunizing exposure, protecting the carrier from future infections by that particular strain. Carriers act as vectors, spreading the bacteria to others through saliva and respiratory secretions.

2) REPORTING CRITERIA AND LABORATORY TESTING SERVICES

A. What to Report to the Massachusetts Department of Public Health

- Any suspect case based on a healthcare provider's impression or a laboratory result indicating *N. meningitidis* (such as gram-negative diplococci in a sterile body site or the isolation of *N. meningitidis* from a sterile body site).

Note: Isolates obtained from sputum or throat cultures are not considered to come from sterile sites; therefore *N. meningitidis* from these sites is in itself not indicative of invasive disease. If a patient with culture-positive sputum has an illness compatible with invasive meningococcal disease, the appropriate sterile sites should then be cultured. See Section 3) C below for information on how to report a case.

B. Laboratory Testing Services Available

The Massachusetts State Laboratory Institute (SLI), Reference Laboratory will confirm and serogroup isolates of *N. meningitidis.* The Reference Laboratory requests that all laboratories submit *all* isolates cultured from normally sterile sites for serogrouping. This serogrouping aids in public health surveillance. In addition, the Reference Laboratory will isolate the organism from appropriate clinical samples upon request. For more information on submitting specimens contact the Reference Laboratory at (617) 983-6607.

3) DISEASE REPORTING AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify close contacts of the case and provide recommendations for appropriate preventive measures for those close contacts and thus prevent further spread of infection.

- To provide information about the disease, its transmission, and methods of prevention.
- To promptly identify clusters or outbreaks of disease and initiate appropriate prevention and control measures.

B. Laboratory and Healthcare Provider Reporting Requirements

Refer to the lists of reportable diseases (at the end of this manual's Introduction) for information.

Note: Due to the potential severity of invasive meningococcal infection, the MDPH requests that information about any case be **immediately reported** to the local board of health where diagnosed. If this is not possible, call the MDPH Division of Epidemiology and Immunization at (617) 983-6800 or (888) 658-2850 (weekdays), or (617) 983-6200 (nights/weekends). A case is defined by the reporting criteria in Section 2) A above.

C. Local Board of Health Reporting and Follow-Up Responsibilities

1. **Reporting Requirements**

Massachusetts Department of Public Health (MDPH) regulations (*105 CMR 300.000*) stipulate that each local board of health (LBOH) must report the occurrence of any case of invasive meningococcal infection, as defined by the reporting criteria in Section 2) A above. Refer to the *Local Board of Health Reporting Timeline* (at the end of this manual's introductory section) for information on prioritization and timeliness requirements of reporting and case investigation.

2. **Case Investigation**

a. Please report suspect or confirmed cases of meningococcal disease **immediately** to the MDPH, Division of Epidemiology and Immunization by calling (617) 983-6800 or (888) 658-2850 (weekdays), or (617) 983-6200 (nights/weekends).

b. After notification to the Division of Epidemiology and Immunization, it is the LBOH responsibility to complete a MDPH *Invasive Meningococcal Disease Case Report Form* (in Appendix A) by interviewing the case and/or others who may be able to provide pertinent information. Division of Epidemiology and Immunization staff are available 24/7 to assist you in the follow-up of a case of invasive meningococcal infection.

c. The main focus when following up a case of invasive meningococcal disease is to prevent additional cases of disease in contacts of the case. The *Suspect Invasive Meningococcal Disease Intake Form* (in Appendix A) will assist you in collecting the appropriate information for complete contact identification and referral. Use this intake form to collect case information that may then be transposed onto the *Invasive Meningococcal Disease Case Report Form*. *This intake form does not replace the Meningococcal Disease Case Report Form* but was designed to assist data collection and case investigation.

d. The first step to following up a case of invasive meningococcal infection is to confirm the diagnosis. Often, reported cases of "meningitis" are ultimately found to be caused by bacteria other than *Neisseria meningitidis* or by a virus. All cases of meningitis need to be reported to the MDPH. However, when *N. meningitidis* is suspected or confirmed, certain public health actions need to be taken to protect contacts.

e. Use the following guidelines to assist you in completing the *Suspect Invasive Meningococcal Disease Intake Form*:
   1) Accurately record the demographic information, collecting as much case information as possible, including address, place of work, occupation, and daycare or school information.
   2) If the case is hospitalized, collect hospital and transfer hospital information if applicable. Hospital laboratories and infection control practitioners are key in obtaining the appropriate information for confirming a diagnosis.

3) Collect clinical information on the case including laboratory data, clinical manifestation, and onset date information. This information is best collected from the infection control practitioner at the hospital or the case's healthcare provider.

4) Collect as much information as possible about the case's activities and contacts during the 2 weeks prior to the onset of illness. This information may be obtained from the case, the case's family and friends, school or daycare personnel, or others involved with the case. Those who meet the definition of a close contact (see Section 4B below) of a case of invasive meningococcal disease must be referred to their healthcare providers for appropriate antibiotic therapy. Sample letters for notifying contacts in a school, daycare or office are available from the Division of Epidemiology and Immunization.

f. Use the following guidelines to assist you in completing the case report form:
   1) If you completed the *Suspect Invasive Meningococcal Disease Intake Form* (above, Part c), most information for the case report form will have been collected and may be transposed.
   2) Indicate the type of infection caused by *N. meningitidis*.
   3) Indicate the type of specimen from which *N. meningitidis* was isolated/identified.
   4) Indicate if *N. meningitidis* was culture-confirmed or indicate other tests performed (*e.g.*, bacterial antigen screen). Also indicate the date the specimen was drawn for the first positive culture.
   5) If known, indicate the serotype of *N. meningitidis* and antibiotic resistance information.
   6) If the case attends daycare or school, list the daycare/school name and provide a contact name and phone number.
   7) If the case attends college, indicate the name of the college, the case's year in school, and the case's living situation.
   8) If the case has received meningococcal vaccine, indicate type of vaccine, date administered, and reason for administration.
   9) If you have made several attempts to obtain case information, but have been unsuccessful (*e.g.*, the case or healthcare provider does not return your calls or respond to a letter, or the case refuses to divulge information or is too ill to be interviewed), please fill out the form with as much information as you have gathered. Please note on the form the reason why it could not be filled out completely.

g. After completing the form, attach all lab report(s) and the *Suspect Invasive Meningococcal Disease Intake Form* and fax or mail (in an envelope marked "Confidential") to the MDPH Division of Epidemiology and Immunization, Surveillance Program. The confidential fax number (617) 983-6813. Call the Surveillance Program at (617) 983-6801 to confirm receipt of the fax. The mailing address is:
   MDPH, Division of Epidemiology and Immunization
   Surveillance Program, Room 241
   305 South Street
   Jamaica Plain, MA 02130

h. Institution of disease control measures is an integral part of case investigation. It is the LBOH responsibility to understand, and, if necessary, institute the control guidelines listed below in Section 4), Controlling Further Spread.

4) CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (*105 CMR 300.200*)

Minimum Period of Isolation of Patient

Until 24 hours after the initiation of appropriate antibiotic therapy.

Minimum Period of Quarantine of Contacts
Personal surveillance and antibiotic prophylaxis, where appropriate.

B. Protection of Contacts of a Case

Prophylaxis: Close contacts of the case should be identified and referred to their healthcare provider for antibiotic prophylaxis. A **close contact** is defined as any members of the case's household or other individuals who had intimate contact with the case's saliva or oral/nasal secretions. Healthcare workers who have intimate contact with the case's oral/nasal secretions (through unprotected mouth-to-mouth resuscitation, intubation, or suctioning) are also considered close contacts.

C. Managing Special Situations

Daycare
A case of invasive meningococcal illness in a daycare setting often causes panic among parents and the community. Although the risk of transmission in this setting remains relatively low, chemoprophylaxis for all the children in the daycare class or the daycare facility may be recommended because the physical interactions between young children are often very close. Surveillance for additional cases of disease should also be heightened. The MDPH *Health and Safety in Child Care: A Guide for Child Care Providers in Massachusetts,* provides detailed recommendations for the follow-up of a case of invasive meningococcal disease in daycare. In addition, contact the Division of Epidemiology and Immunization to report suspect or confirmed cases in a daycare (or any other setting). An epidemiologist will work with you to ensure all contacts are identified and notified. In addition, surveillance for new cases of disease should continue at the facility for at least 2 weeks after the onset of the first case. If multiple cases occur, surveillance should continue for 2 weeks after the onset of the last case.

School
A case of invasive meningococcal illness in a school often causes panic among parents and the community. Although the risk of transmission in a school remains relatively low, the age of the case will determine the extent of chemoprophylaxis necessary. Because the physical interactions between young children are often very close, chemoprophylaxis for all the children in the case's class may be recommended if the child is in early elementary school. A high school or college student, on the other hand, usually has a more defined group of close contacts and chemoprophylaxis may be more targeted. The MDPH *Comprehensive School Health Manual* provides detailed recommendations for the follow-up of a case of invasive meningococcal disease in a school. Surveillance for additional cases of disease should also be heightened. In addition, contact the Division of Epidemiology and Immunization to report suspect or confirmed cases in a school (or any other setting). An epidemiologist will work with you to ensure all contacts are identified and notified. In addition, surveillance for new cases of disease should continue at the school for at least 2 weeks after the onset of the first case. If multiple cases occur, surveillance should continue for 2 weeks after the onset of the last case.

Community Residential Program
If a case of meningococcal disease occurs in a residential program, close contacts of the case should be referred to their healthcare provider for chemoprophylaxis. The activity in the facility should be assessed to determine the level of interaction between residents. The facility may be considered a household setting and require chemoprophylaxis of all residents, or the chemoprophylaxis may be more targeted. Contact the Division of Epidemiology and Immunization for assistance in following up a case of invasive meningococcal disease in residential programs. In addition, surveillance for new cases of disease in the facility should continue for at least 2 weeks after the onset of the first case. If multiple cases occur, surveillance should continue for 2 weeks after the onset of the last case.

Reported Incidence Is Higher than Usual/Outbreak Suspected
If the number of reported cases in your city/town is higher than usual for the time of year, or if you suspect an outbreak, please immediately contact the Division of Epidemiology and Immunization at (617) 983-6800 or (888) 658-2850. This situation may warrant an investigation of clustered cases to determine a course of action to prevent further cases. The MDPH can perform surveillance for clusters of illness that may cross several town lines and therefore be difficult to identify at a local level.

D. Preventive Measures

Personal Preventive Measures/Education
To prevent additional cases:

- Refer close contacts to healthcare providers for appropriate chemoprophylaxis.
- Advise contacts of signs and symptoms of illness and refer them to their healthcare provider should they experience any symptoms compatible with invasive meningococcal disease.
- Provide close contacts with a *Meningococcal Disease Public Health Fact Sheet* available from the Division of Epidemiology and Immunization or through the MDPH website at <http://www.state.ma.us/dph/>. Click on the "Publications" link and scroll down to the Fact Sheets section.

To avoid future exposures advise individuals to:

- Practice good hygiene and handwashing.
- Avoid sharing food, beverages, cigarettes or eating utensils.
- Consider immunization in certain circumstances (see below).

Immunization
A vaccine protecting against four serogroups (A, C, Y, and W-135) of *N. meningitidis* is available. The vaccine is not recommended for routine use, but is recommended for travelers to endemic countries, certain high-risk individuals, and in the case of an outbreak of invasive disease (as defined by the Advisory Committee on Immunization Practices [ACIP]). On October 20, 1999, the ACIP modified its recommendations for the use of meningococcal vaccine in college students. The ACIP recommends that healthcare providers of college students provide information to students and their parents about meningococcal disease and the benefits of vaccination. In particular, vaccination should be made easily available to freshman students. The MDPH strongly encourages students and their parents to talk with their healthcare providers about the meningococcal vaccine and the specific circumstances of the student.

Although routine administration of meningococcal vaccine to all college students is not currently recommended, meningococcal vaccine may be appropriate for certain students depending on their living conditions and behavioral exposure risks. *N. meningitidis* is spread through direct contact with oral or nasal secretions of a carrier. A closed setting such as a college dormitory, combined with high-risk behaviors in college students (alcohol consumption, exposure to tobacco smoke, sharing food or beverages, activities involving the exchange of saliva, etc.), may cause some college students to be at greater risk for invasive infection. Healthcare providers should discuss these risk factors and the likelihood that their patients will be involved in high-risk behaviors when evaluating patients for the administration of meningococcal vaccine.

ADDITIONAL INFORMATION

The following is the formal Centers for Disease Control and Prevention (CDC) case definition for invasive meningococcal disease. It is provided for your information only; it is not necessary to use this information for reporting or investigating a case. (CDC case definitions are used by state health departments and CDC to maintain uniform national reporting standards.) For reporting to the MDPH, always use the criteria in Section 2) A.

Clinical description
Meningococcal disease manifests most commonly as meningitis and/or mengococcemia that may progress rapidly to purpura fulminans, shock, and death. However other manifestations might be observed.

Laboratory criteria for diagnosis
- Isolation of *N. meningitidis* from a normally sterile site (*e.g.*, blood or CSF or, less commonly, joint, pleural or pericardial fluid).

Case classification
Confirmed: A clinically compatible case that is laboratory confirmed.
Probable: A case with positive antigen test in cerebrospinal fluid (CSF) or clinical purpura fulminans in the absence of a positive blood culture.

Comment
Positive antigen test results from urine or serum samples are unreliable for diagnosing meningococcal disease.

REFERENCES

Ala'Aldeen, D. A. A., *et al*. Dynamics of Meningococcal Long-Term Carriage among University Students and Their Implications for Mass Vaccination. *Journal of Clinical Microbiology*. June 2000, Vol. 38, No. 6.

American Academy of Pediatrics. *Red Book 2000: Report of the Committee on Infectious Diseases, 25th Edition*. Illinois, American Academy of Pediatrics, 2000.

CDC. Case Definitions for Infectious Conditions Under Public Health Surveillance, *MMWR*. 1997; 46:RR-10.

CDC. Control and Prevention of Meningococcal Disease and Control and Prevention of Serogroup C Meningococcal Disease: Evaluation and Management of Outbreaks. *MMWR*, February 14, 1997; 46:RR-5.

CDC Website. ACIP Modifies Recommendations for Meningitis Vaccination (Press Release). Available at <http://www.cdc.gov/od/oc/media/pressrel/r991021.htm>. Released October 21, 1999.

Chin, J., ed., *Control of Communicable Diseases Manual, 17th Edition*. Washington, DC, American Public Health Association, 2000.

Mandell, G., Bennett, J., and Dolin, R., *Principles and Practice of Infectious Diseases, 4th Edition*. New York. Churchill Livingston, 1995.

MDPH. *The Comprehensive School Health Manual*. MDPH, 1995.

MDPH. *Health and Safety in Child Care: A Guide for Child Care Providers in Massachusetts*. MDPH, 1995.

MDPH. *Regulation 105 CMR 300.000: Reportable Diseases and Isolation and Quarantine Requirements*. MDPH, Promulgated November 1998, (Printed July 1999).